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(54) **PERIPHERAL DEVICE USED WHILE BEING CONNECTED TO INFORMATION PROCESSING APPARATUS**

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CPC ***G06F 9/4411*** (2013.01); ***G06F 13/102*** (2013.01)

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USPC 358/1.15, 1.13; 714/E11.136; 707/822, 707/823
See application file for complete search history.

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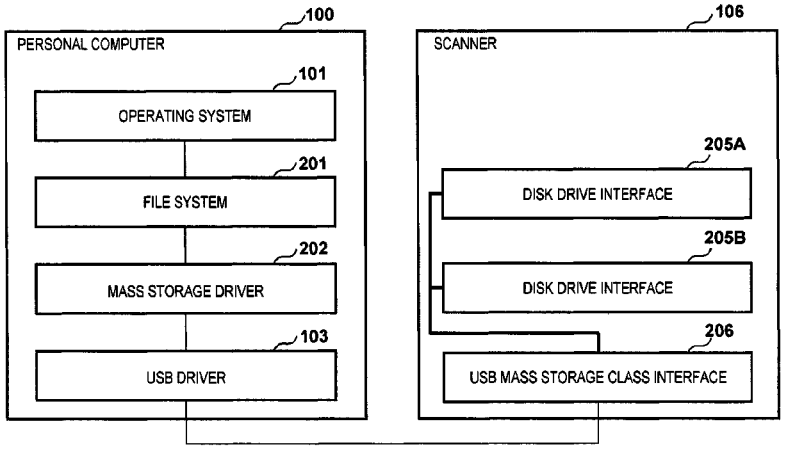
(57) **ABSTRACT**

A peripheral device is selectively connected to an information processing apparatus including a first operating system and an information processing apparatus including a second operating system whose execution file is incompatible with that of the first operating system. The storage unit of the peripheral device stores a control program to be executed by the information processing apparatus. The control program includes a first control program to be executed on the first operating system and a second control program to be executed on the second operating system. After the peripheral device transmits the control program to the information processing apparatus, the information processing apparatus writes instruction information in the storage unit of the peripheral device in accordance with the control program. The peripheral device operates based on the instruction information.

13 Claims, 8 Drawing Sheets



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Kinoshita, Kenji, "Sharing an external HDD on Mac and Windows", Mac Fan, ASCII Media Works Co. Ltd., vol. 17, Issue 7, p. 124, Jul. 2009.

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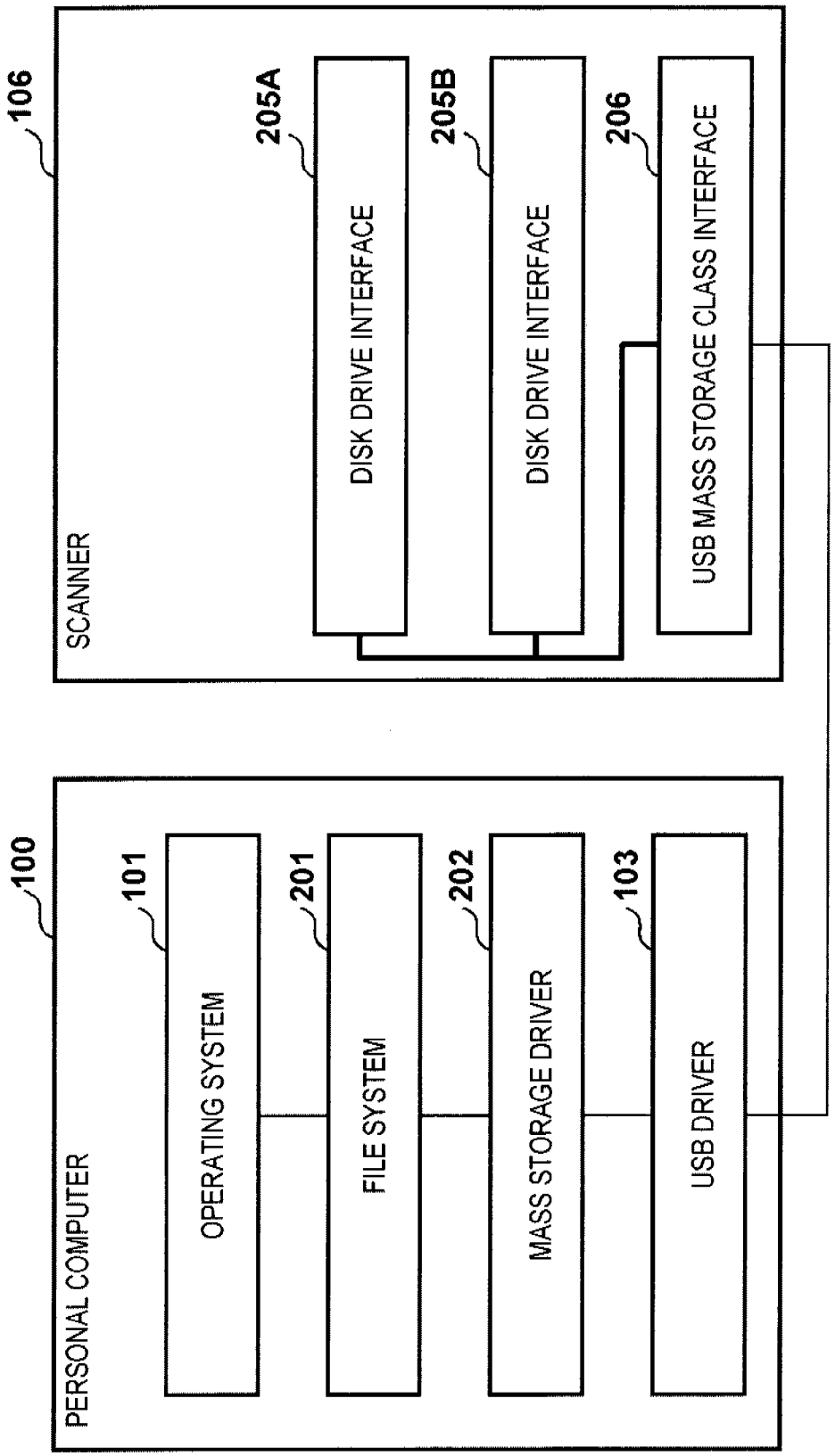
FIG. 1


106
SCANNER
205A
DISK DRIVE INTERFACE
205B
DISK DRIVE INTERFACE
206
USB MASS STORAGE CLASS INTERFACE
100
PERSONAL COMPUTER
101
OPERATING SYSTEM
201
FILE SYSTEM
202
MASS STORAGE DRIVER
103
USB DRIVER

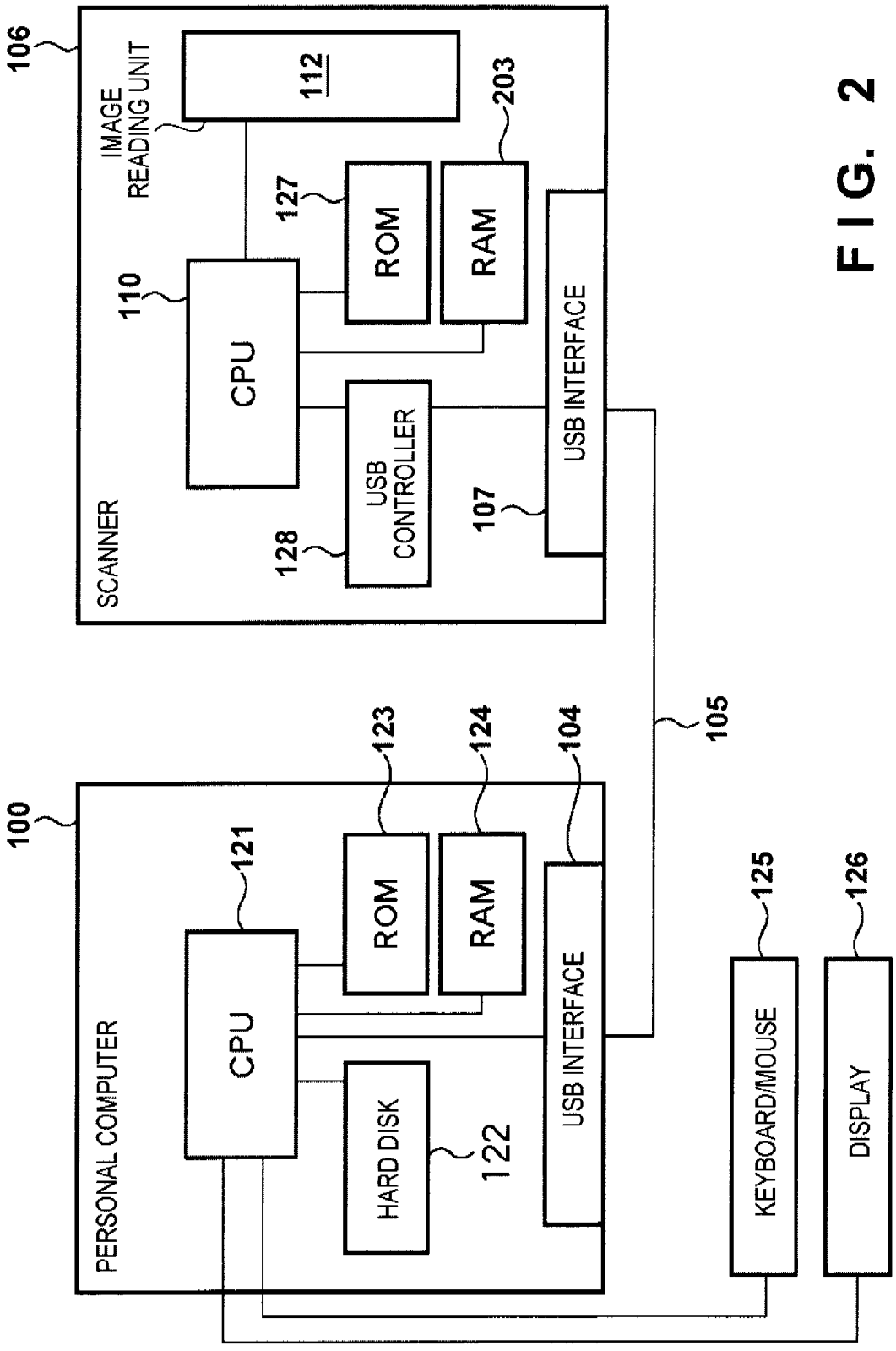

106
SCANNER
IMAGE READING UNIT
112
203
127
ROM
RAM
110
CPU
USB CONTROLLER
128
107
USB INTERFACE
105
100
PERSONAL COMPUTER
121
CPU
123
ROM
124
RAM
104
USB INTERFACE
HARD DISK
122
125
KEYBOARD/MOUSE
126
DISPLAY

FIG. 2

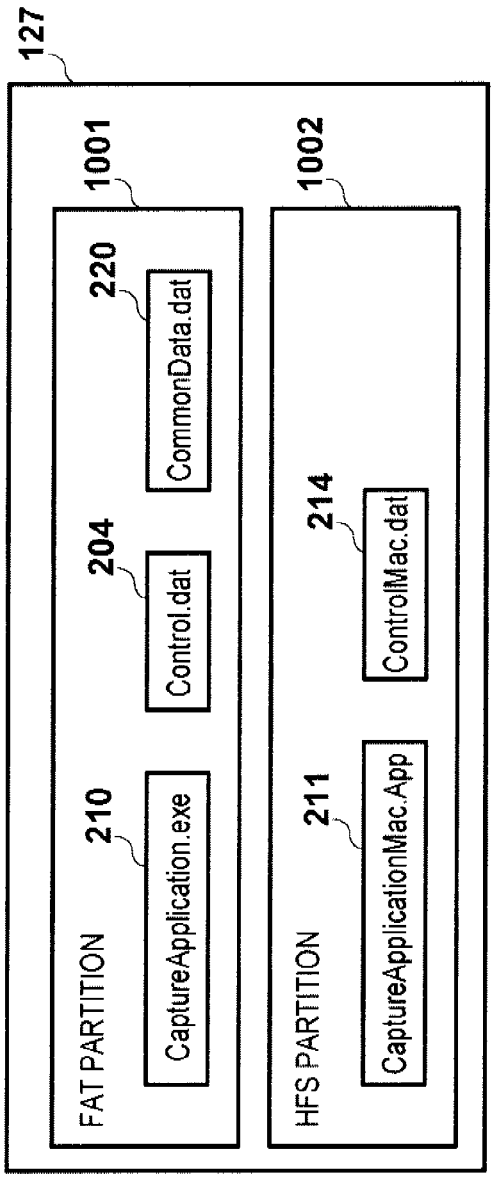

127
1001
1002
220
CommonData.dat
204
Control.dat
214
ControlMac.dat
FAT PARTITION
210
CaptureApplication.exe
HFS PARTITION
211
CaptureApplicationMac.App

FIG. 3A

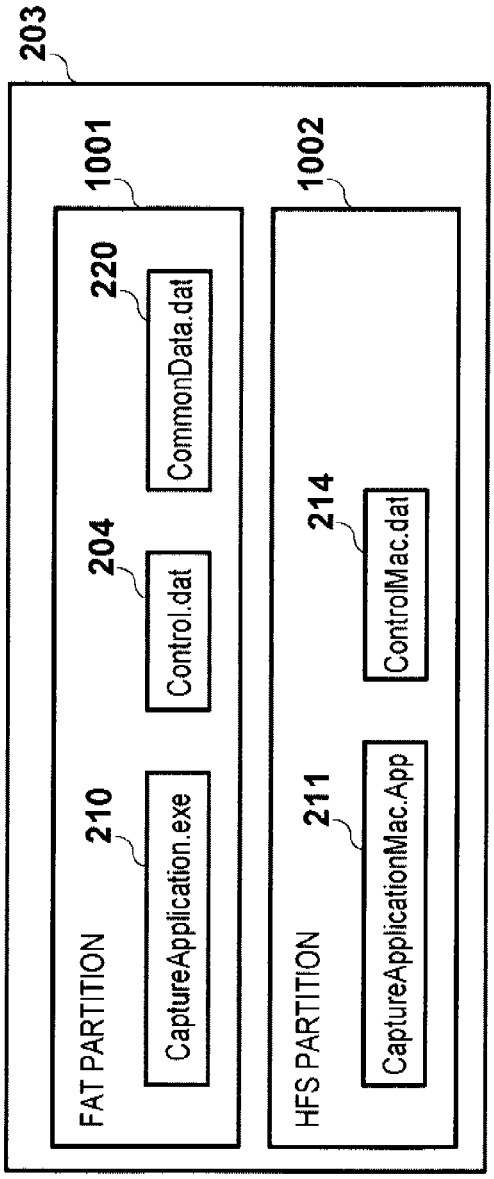

203
1001
1002
220
CommonData.dat
204
Control.dat
214
ControlMac.dat
FAT PARTITION
210
CaptureApplication.exe
HFS PARTITION
211
CaptureApplicationMac.App

FIG. 3B

FIG. 4

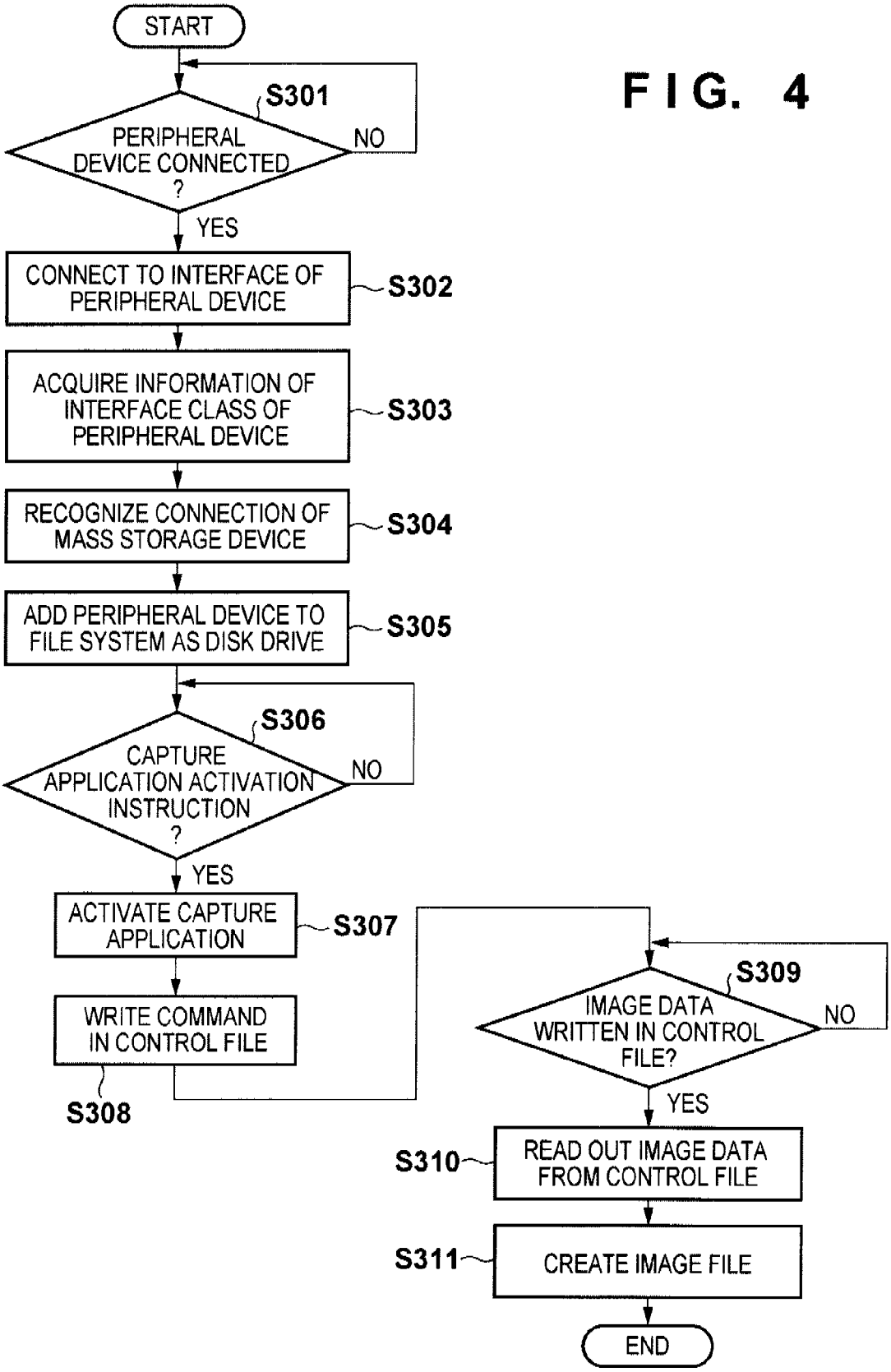

START
S301
PERIPHERAL DEVICE CONNECTED ?
NO
YES
CONNECT TO INTERFACE OF PERIPHERAL DEVICE
S302
ACQUIRE INFORMATION OF INTERFACE CLASS OF PERIPHERAL DEVICE
S303
RECOGNIZE CONNECTION OF MASS STORAGE DEVICE
S304
ADD PERIPHERAL DEVICE TO FILE SYSTEM AS DISK DRIVE
S305
S306
CAPTURE APPLICATION ACTIVATION INSTRUCTION ?
NO
YES
ACTIVATE CAPTURE APPLICATION
S307
WRITE COMMAND IN CONTROL FILE
S308
S309
IMAGE DATA WRITTEN IN CONTROL FILE?
NO
YES
S310
READ OUT IMAGE DATA FROM CONTROL FILE
S311
CREATE IMAGE FILE
END

FIG. 5

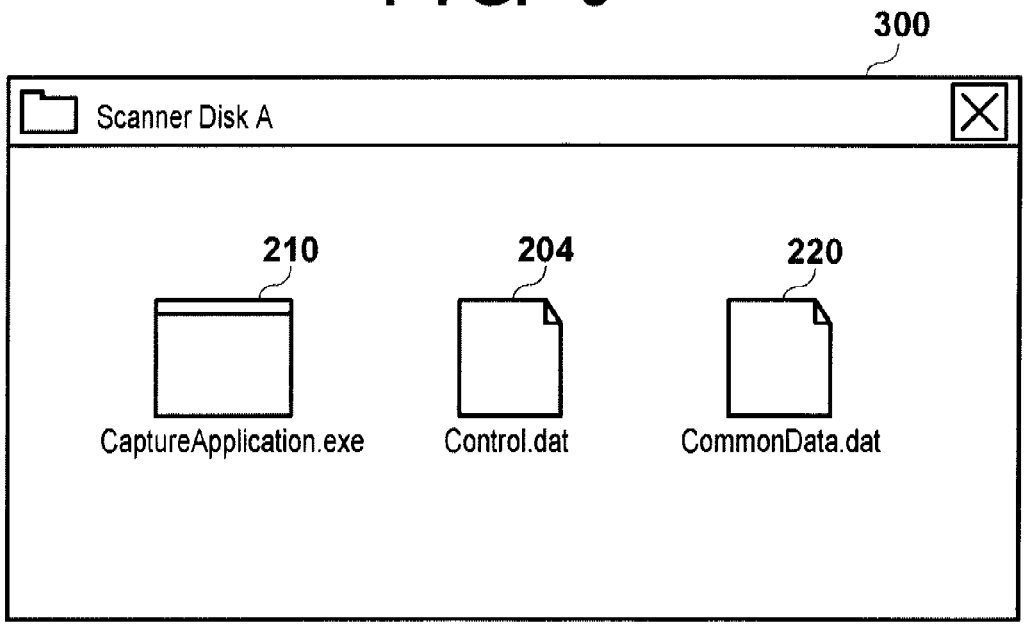

300
Scanner Disk A
210
204
220
CaptureApplication.exe
Control.dat
CommonData.dat

FIG. 6

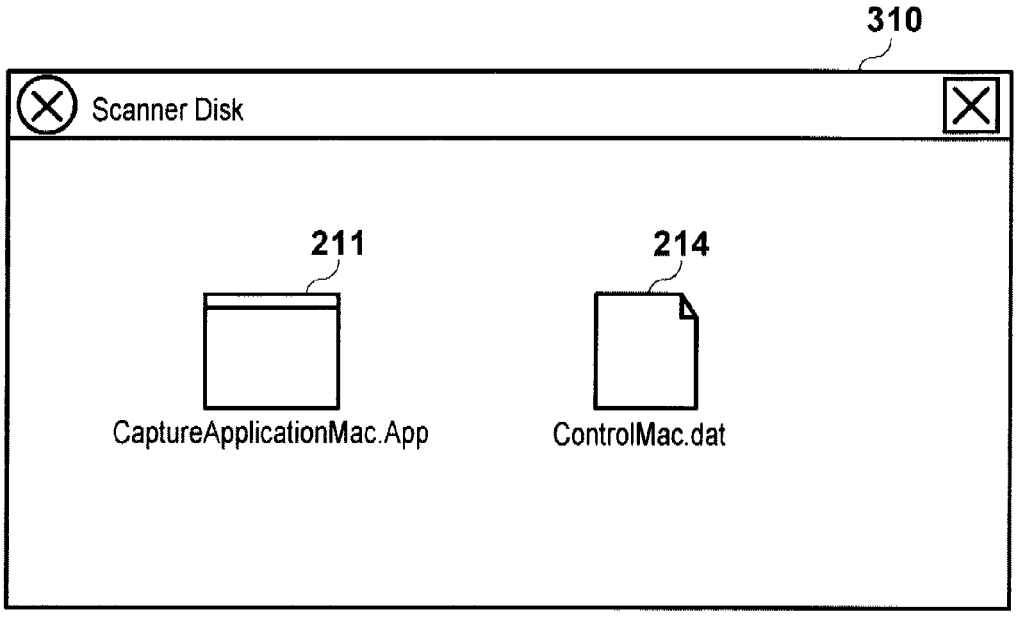

310
Scanner Disk
211
214
CaptureApplicationMac.App
ControlMac.dat

FIG. 7

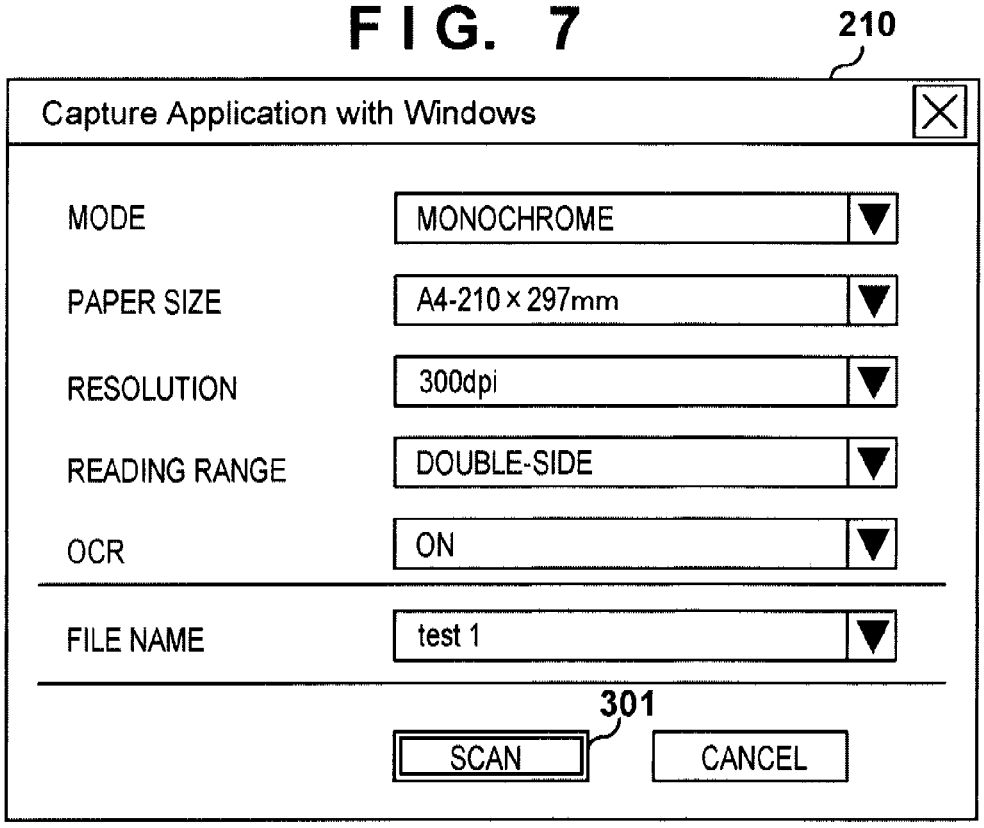

210
Capture Application with Windows
MODE
MONOCHROME
PAPER SIZE
A4-210 x 297mm
RESOLUTION
300dpi
READING RANGE
DOUBLE-SIDE
OCR
ON
FILE NAME
test 1
301
SCAN
CANCEL

FIG. 8

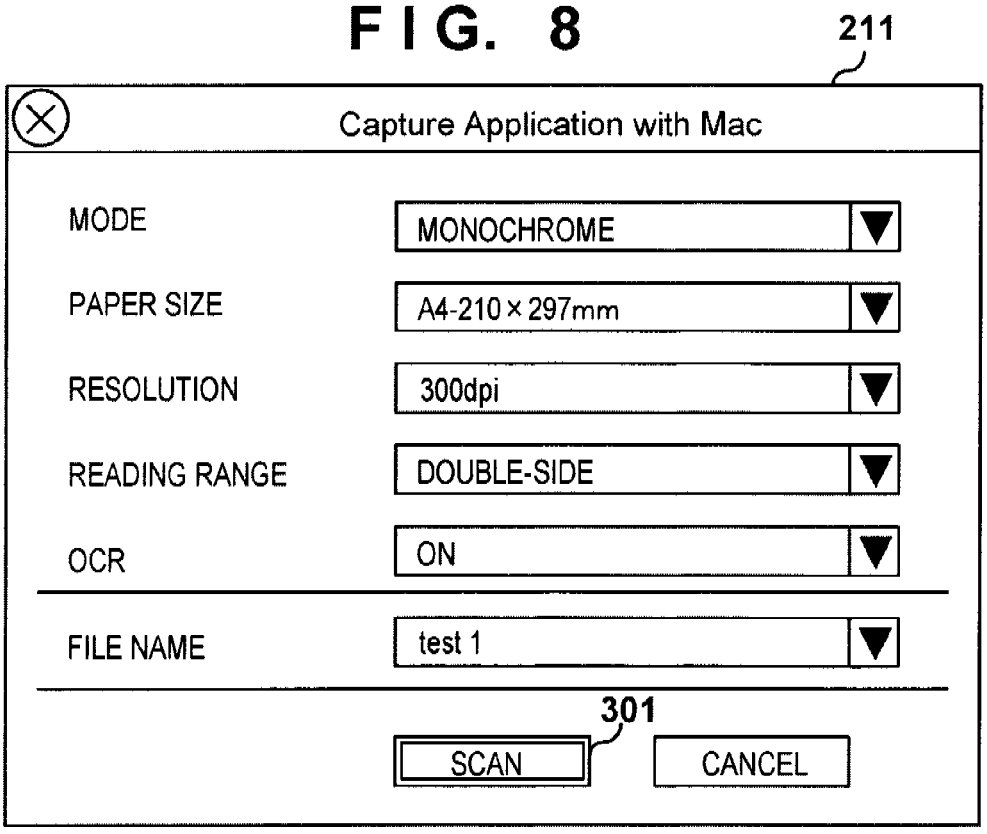

211
Capture Application with Mac
MODE
MONOCHROME
PAPER SIZE
A4-210 x 297mm
RESOLUTION
300dpi
READING RANGE
DOUBLE-SIDE
OCR
ON
FILE NAME
test 1
301
SCAN
CANCEL

FIG. 9A

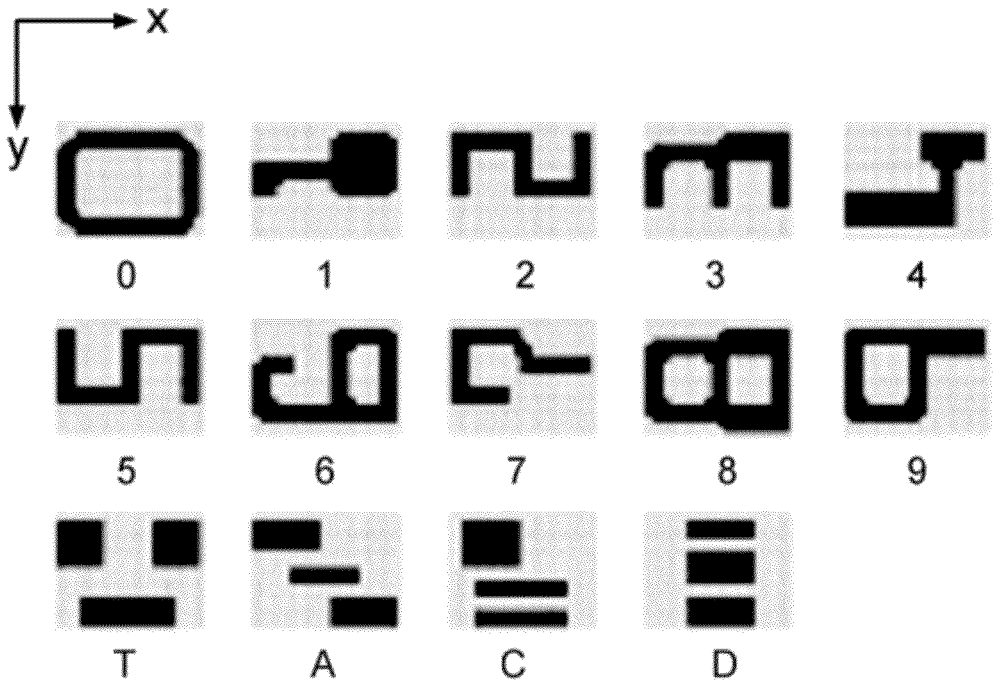


FIG. 9B

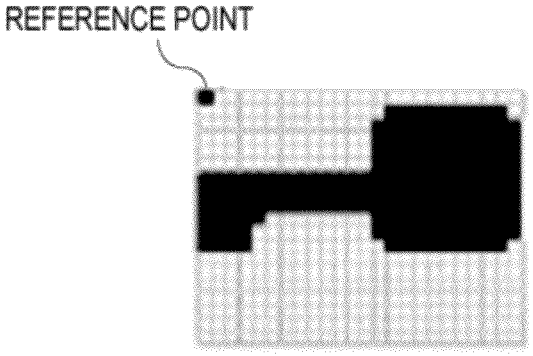
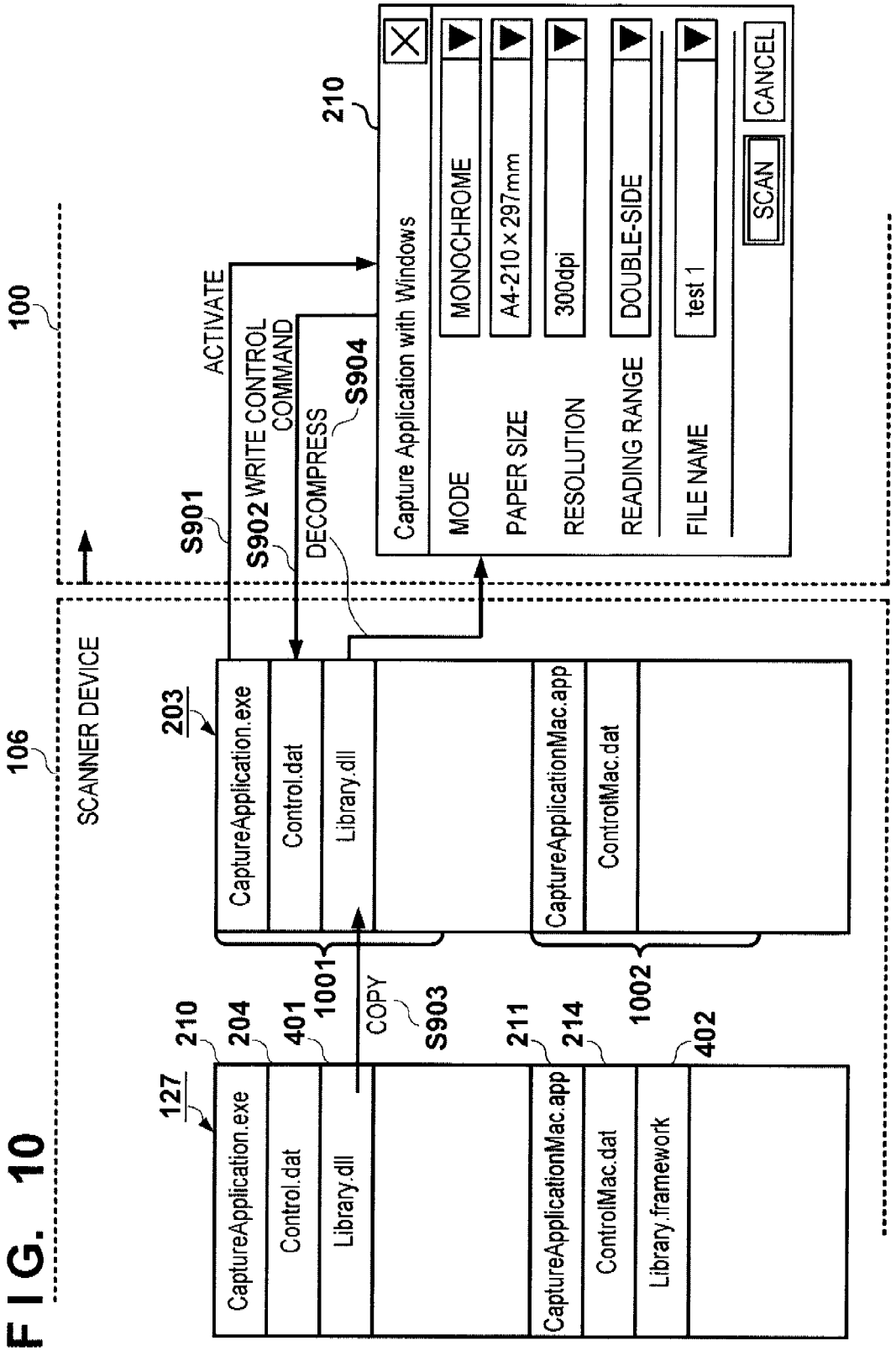


FIG. 10


100
106
SCANNER DEVICE
127
210
204
401
1001
CaptureApplication.exe
Control.dat
Library.dll
COPY
S903
211
214
1002
402
CaptureApplicationMac.app
ControlMac.dat
Library.framework
203
CaptureApplication.exe
Control.dat
Library.dll
CaptureApplicationMac.app
ControlMac.dat
S901
ACTIVATE
S902 WRITE CONTROL COMMAND
DECOMPRESS
S904
210
Capture Application with Windows
MODE
MONOCHROME
PAPER SIZE
A4-210 x 297mm
RESOLUTION
300dpi
READING RANGE
DOUBLE-SIDE
FILE NAME
test 1
SCAN
CANCEL

PERIPHERAL DEVICE USED WHILE BEING CONNECTED TO INFORMATION PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a peripheral device such as an image scanner, a printer, or a multifunction peripheral, an image reading apparatus, and an information processing system.

2. Description of the Related Art

Peripheral devices such as an image scanner, a printer, or a multifunction peripheral have widely been proliferated. To use a peripheral device connected to a computer, a device driver and application software for the peripheral device need to be installed (Japanese Patent Laid-Open No. 2004-334449).

On the other hand, due to the rise of awareness of security, installation of a device driver and application software is limited in some computers. For example, security measures are generally taken to allow a user who has administrator authority to install a device driver but prohibit a general user from installing a device driver and application software. This leads to an increase in inconvenient environments where a peripheral device cannot easily be used.

To improve such an inconvenient environment, there is proposed a technique of making a peripheral device usable without installing a device driver and application software in a computer (Japanese Patent Laid-Open No. 2010-113702).

A plurality of different types of operating systems have become popular in the market. In some cases, one user will use a plurality of operating systems. Such a user may want to use one peripheral device on the plurality of operating systems. Even under this circumference, it would be convenient if the user could use the peripheral device without installing a device driver and application software in the computer.

However, the device driver or application software normally has a different execution file format for each operating system. That is, the device driver or application software has no compatibility with the different types of operating systems. Hence, device drivers, software, and data necessary for the plurality of operating systems need to be installed in the storage device of the peripheral device.

SUMMARY OF THE INVENTION

The present invention provides a peripheral device usable from a plurality of operating systems without installing a device driver and software.

According to the present invention, there is provided a peripheral device for executing predetermined processing based on instruction information from an information processing apparatus. In the peripheral device, a storage unit stores a control program to be executed by the information processing apparatus to control the peripheral device. A control unit controls an operation of the peripheral device based on the instruction information written in the storage unit from the information processing apparatus when the information processing apparatus executes the control program in a state in which the information processing apparatus recognizes a storage area of the peripheral device. The peripheral device is selectively connectable to an information processing apparatus including a first operating system and an information processing apparatus including a second operating system whose execution file is incompatible with that of the first operating system. The storage unit stores, as the control program, a first control program to be executed by the information processing apparatus including the first operating system, and a second control program to be executed by the information processing apparatus including the second operating system.

Further features of the present invention will become apparent from the following description of exemplary embodiments (with reference to the attached drawings).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the system arrangement of a computer exemplified as a personal computer and a scanner serving as an image reading apparatus according to the embodiment of the present invention;

FIG. **2** is a block diagram showing the hardware arrangement of the scanner and the computer exemplified as a personal computer;

FIG. **3**A is a block diagram showing the partition arrangement of a ROM **127** in a scanner device **106** and a software configuration stored in the ROM;

FIG. **3**B is a block diagram showing the partition arrangement of the ROM **127** in the scanner device **106** and a software configuration stored in the ROM;

FIG. **4** is a flowchart of a procedure of causing the scanner device **106** to read an image by using a capture application **210** from a computer **100**;

FIG. **5** is a view showing a state in which a FAT disk drive (scanner) is opened by file management software (explorer);

FIG. **6** is a view showing a state in which an HFS+ disk drive (scanner) is opened by file management software (finder);

FIG. **7** is a view showing an example of a user interface displayed upon activating the capture application **210**;

FIG. **8** is a view showing an example of a user interface displayed upon activating a capture application Mac **211**;

FIGS. **9**A and **9**B are views showing the structure of OCR data; and

FIG. **10** is a view showing processing of loading a library module from the scanner device **106** to the computer **100** in a case in which an operating system **101** of the computer **100** is Windows®.

DESCRIPTION OF THE EMBODIMENTS

FIG. **1** is a block diagram showing the system arrangement of a computer exemplified as a personal computer and a scanner serving as an image reading apparatus according to the embodiment of the present invention.

An operating system **101**, a file system **201**, a USB mass storage driver **202**, and a USB interface driver **103** are installed in a computer **100** that is an example of an information processing apparatus. The operating system **101** is the basic software of the computer **100**. The file system **201** is software configured to store files in a storage device such as a hard disk drive. The USB mass storage driver **202** is software configured to control a mass storage such as a hard disk drive, a CD-ROM, a DVD-ROM, a CD-R, a DVD-R, or a USB memory. The USB interface driver **103** is software configured to control a USB device connected to the USB interface. Note that these software programs may be part of the operating system.

A scanner device **106** is an example of a peripheral device to which an information processing apparatus including a first operating system and an information processing apparatus including a second operating system that uses an execution file incompatible with the first operating system are selec-

tively connected. In other words, the scanner device **106** of this embodiment supports multiple OSs and therefore has compatibility with a plurality of operating systems (OSs). The following example will be described assuming that the first operating system is Windows®, and the second operating system is Mac OS®. However, the present invention is not limited to such combination and arrangement.

The scanner device **106** that is an example of a peripheral device for executing predetermined processing in accordance with instruction information from the information processing apparatus includes two USB disk drive interfaces **205**A and **205**B and a USB mass storage class interface **206**. The USB disk drive interfaces **205**A and **205**B are software programs configured to use a memory (for example, a ROM, a RAM, a flash memory, or an EEPROM) in the scanner device **106** as a disk drive. The USB mass storage class interface **206** is software configured to use the memory as a USB mass storage via the USB disk drive interfaces **205**A and **205**B.

Note that a general scanner device includes a USB scanner class interface in place of these software programs. For this reason, the personal computer needs to have capture application software and a dedicated scanner driver. In this embodiment, the USB scanner class interface is not always necessary. In addition, the capture application software and dedicated scanner driver are not always necessary on the personal computer side.

FIG. **2** is a block diagram showing the hardware arrangement of the scanner and the computer exemplified as a personal computer. Referring to FIG. **2**, the computer **100** includes a CPU **121**, a ROM **123**, a RAM **124**, a hard disk drive **122**, and a USB interface **104**. The USB interface **104** is connected to the scanner device **106** via a USB cable **105**. The CPU **121** is connected to a keyboard/mouse **125** and a display **126**.

When the computer **100** is powered on, the CPU **121** activates firmware from the ROM **123** and activates the operating system **101** such as Windows® or Mac OS® from the hard disk drive **122**. The operating system **101** may be based on UNIX®. Necessary software programs such as the operating system are loaded to the RAM **124**.

On the other hand, the scanner device **106** includes a CPU **110**, a ROM **127**, a RAM **203**, an image reading unit **112**, a USB controller **128**, and a USB interface **107**. When the scanner device **106** is powered on, the CPU **110** activates firmware from the ROM **127**. The firmware may be activated from a nonvolatile memory (not shown). The USB controller **128** is a control circuit that supports the USB mass storage class interface **206** and the USB disk drive interfaces **205**A and **205**B from the hardware side.

When some peripheral device is connected to the USB interface **104** via the USB cable **105**, the operating system **101** on the computer **100** accesses the interface of the peripheral device to determine the type of the peripheral device. The scanner device **106** is recognized as a mass storage device class by the operating system **101**. This is because the USB mass storage driver **202** that controls the mass storage device class is provided in the computer in advance and need not be installed anew. Hence, the scanner device **106** of this embodiment includes the USB mass storage class interface **206**.

The operating system **101** such as Windows® or Mac OS® supports a USB device of mass storage class as standard. When the CPU **121** accesses a USB device of mass storage class, no special device driver or the like need be installed in the computer **100** because the operating system **101** includes a USB driver of mass storage class (USB mass storage driver **202**). In addition, standard access to the mass storage class device can be executed using the operating system **101** without administrator authority.

Hence, when the scanner device **106** is connected to the computer **100**, the CPU **121** activates the USB mass storage driver **202** installed in advance. In addition, when the scanner device **106** is connected to the computer **100**, the CPU **121** and the operating system **101** recognize the scanner device **106** as a mass storage device because the scanner device **106** has the USB mass storage class interface **206**. The CPU **121** and the operating system **101** access the ROM **127** and the RAM **203** of the scanner device **106** by regarding them as external storage devices.

The recognition processing will be described in more detail. When the scanner device **106** is connected to the computer **100**, the operating system **101** (CPU **121**) detects connection of some peripheral device to the USB interface **104**, and accesses the USB interface **107** of the scanner device **106** via the USB cable **105**. When the USB interface **107** is accessed from the computer **100**, the CPU **110** of the scanner device **106** causes the computer **100** to access the USB mass storage class interface **206**. The operating system **101** accesses the USB mass storage class interface **206** of the scanner device **106**, thereby accessing the scanner device **106** via the USB cable **105** from the USB interface driver **103** and the USB interface **104** using the USB mass storage driver **202** included in the operating system **101** in advance.

The scanner device **106** is recognized as a mass storage class device by the operating system **101**. For this reason, the computer **100** can access the scanner device **106** using an access method that does not depend on the presence/absence of administrator authority via the USB interface **107**, the USB mass storage class interface **206**, and the USB disk drive interfaces **205**A and **205**B of the scanner device **106**. However, the computer **100** can only access the scanner device **106** as a storage device but not directly control the image reading unit **112**.

In the scanner device **106**, various kinds of files to be used to control it are stored in the ROM **127**. Examples are control programs such as capture applications and library files to be executed by the computer **100** and control programs such as firmware to be executed by the scanner device **106** itself. Various kinds of data to be used together with the control programs are also stored in the ROM **127**. In this embodiment, a capture application is a program that runs on the operating system **101** of the computer **100** and is not to be executed by the scanner device **106**.

The computer **100** forms, in a file folder associated with the file system **201**, a table corresponding to the control files and the capture applications stored in the scanner device **106**. If the computer **100** cannot recognize the file system, the corresponding table is not formed. For example, a Window®-based operating system cannot recognize an HFS-based file system or a UNIX®-based file system. For this reason, when a partition formatted by a FAT file system and a partition formatted by an HFS file system (HFS+ file system) are stored in the scanner device **106**, the Windows®-based operating system recognizes the FAT file system but not the HFS+ file system. On the other hand, the Mac OS®—or UNIX®-based operating system can recognize both file systems.

FIG. **3**A is a block diagram showing the partition arrangement of the ROM **127** in the scanner device **106** and a software configuration stored in the ROM. In this embodiment, at least two partitions are allocated in the ROM **127**. That is, a FAT partition **1001** is formatted by the FAT file system, which is an example of a first partition accessible by both the first operating system and the second operating system. An HFS+

partition **1002** is formatted by the HFS+ file system, which is an example of a second partition inaccessible by the first operating system but accessible by the second operating system.

In this embodiment, CaptureApplication.exe **210** and CaptureApplicationMac.app **211** are capture applications including a driver program and executed by the CPU **121** of the computer **100** to control image reading. Note that in the following description, the CaptureApplication.exe **210** and the CaptureApplicationMac.app **211** will generically be referred to as capture application unless it is necessary to explicitly point out. The CaptureApplication.exe **210** is an example of a first control program to be executed by the information processing apparatus including the first operating system. The CaptureApplicationMac.app **211** is an example of a second control program to be executed by the information processing apparatus including the second operating system.

Control.dat **204** and ControlMac.dat **214** are control files in which control commands and the like from the computer **100** that is executing the capture application **210** are written to control the scanner device **106**. The computer **100** recognizes the scanner device **106** as a mass storage and therefore indirectly controls the scanner device **106** by writing a control command in the control file. Note that in the following description, the Control.dat **204** and the ControlMac.dat **214** will generically be referred to as control file unless it is necessary to explicitly point out.

The CaptureApplication.exe **210** and the Control.dat **204** are files programmed to run on Windows®. The CaptureApplicationMac.app **211** and the ControlMac.dat **214** are files programmed to run on Mac OS®.

CommonData.dat **220** is an example of data to be commonly used by the information processing apparatus including the first operating system and the information processing apparatus including the second operating system. The CommonData.dat **220** is OCR data (character data) to be used in OCR (Optical Character Recognition) that is a function of the capture application.

Independency of OCR data from each operating system will be described here. In general, in OCR, an image acquired by the scanner device **106** is compared with OCR data. Characters are recognized by determining as a result of comparison whether the difference between the image and the OCR data is small. That is, OCR data with the minimum difference to the image acquired by the scanner device **106** is selected from a plurality of OCR data. The OCR data is formed from an image data group to be compared with an image acquired by the scanner device **106**. The OCR data becomes larger in proportional to the number of characters to be recognized. For this reason, when supporting various languages, the data size readily becomes enormous.

FIGS. **9**A and **9**B are views showing the OCR data used in OCR. FIG. **9**A shows some data of the image data group. FIG. **9**B is an enlarged view of the image of a character "1". As shown in FIGS. **9**A and **9**B, the image group constituting the OCR data is generally provided as an image data sequence in which the character height direction is defined as the x direction, and a direction perpendicular to the x direction is defined as the y direction. That is, the OCR data is binary data formed from a pixel data sequence. The binary data does not depend on the program rule of an operating system. For this reason, the binary data does not depend on each operating system.

The problem is the increase in the program size and the size of data to be used from the programs caused by the above-described expansion of functionality of a device driver and software.

For example, the OCR data is provided as a pixel data sequence. For this reason, the OCR data may be required to include the pixel data of all characters and all fonts to be recognized by the OCR. For example, when the OCR data shown in FIGS. **9**A and **9**B is formed from pixel data each having one byte, and the recognition target includes all character images of English and Japanese, the file size is very large. As described above, there is concern about an increase in cost caused by an increase in the storage capacity necessary for storing such data. Hence, data that does not depend on the type of the operating system can be shared and commonly used by a plurality of operating systems. For example, the OCR data does not depend on the type of the operating system. Thus, the OCR data can be shared and commonly used by a plurality of operating systems.

Instead of directly making the ROM **127** open on the computer **100**, the contents of the ROM **127** may be copied to the RAM **203**, and part of the storage area of the RAM **203** may be made open on the computer **100**. This allows to suppress alteration of the storage contents of the ROM **127** by the computer **100**.

In this case, out of the above-described files stored in the ROM **127**, files to be used by the computer **100** are copied to the RAM **203** by the CPU **110**. That is, when the scanner device **106** is activated, the CPU **110** creates a drive to make part of the RAM **203** open on the computer **100** in accordance with the firmware. The scanner device **106** is thus recognized by the computer **100** as a drive like a USB memory. The CPU **110** also creates at least two partitions in the drive, formats the two partitions by different file systems, and copies the files from the ROM **127** to the partitions. Note that when the ROM **127** is formed from a flash memory® or EEPROM, copy to the RAM **203** is omitted. The following description will be made assuming that the files are copied to the RAM **203**. The RAM **203** is made open as a drive so that the computer **100** and the scanner device **106** can transmit/receive commands and image data through the drive. Since the computer **100** can only recognize the scanner device **106** as a drive, such contrivance would be needed to use the scanner device **106** as an image reading apparatus.

The USB disk drive interface **205**A shown in FIG. **1** is designed in correspondence with the FAT partition **1001** formatted by the FAT file system. On the other hand, the USB disk drive interface **205**B is designed in correspondence with the HFS+ partition **1002** formatted by the HFS+ file system.

FIG. **4** is a flowchart from connection of the scanner device **106** to the computer **100** to image reading by the scanner device **106**.

In step S**301**, the CPU **121** of the computer **100** determines whether the scanner device **106** is connected. In step S**302**, the CPU **121** is connected to the interface of the peripheral device (scanner device **106**). In step S**303**, the CPU **121** acquires information of the interface class of the peripheral device from the scanner device **106**. In step S**304**, the CPU **121** recognizes the type of the peripheral device from the information of the interface class of the peripheral device. As described above, the scanner device **106** has the USB mass storage class interface **206**. Hence, when the scanner device **106** is connected to the computer **100**, the CPU **121** recognizes that a USB mass storage device is connected. In addition, the scanner device **106** has the USB disk drive interfaces **205**A and **205**B as the subclass of the USB mass storage class interface **206**. For this reason, the CPU **121** recognizes the connected scanner device **106** as two separate disk drives.

In step S**305**, the operating system **101** forms, in a file folder associated with the file system **201**, a table corresponding to the files stored in the scanner device **106**. This enables

the CPU **121** to handle each file stored in the scanner device **106** as a file on the disk drive. If the operating system **101** cannot associate the table corresponding to the files stored in the scanner device **106** with the file system **201**, the disk drive is not recognized so as to be inoperable.

FIG. **5** is a view showing a state in which the disk drive corresponding to the USB disk drive interface **205**A is opened by file management software. The FAT partition allocated in the internal memory of the scanner device **106** corresponds to a folder **300**.

The folder **300** can be opened using the keyboard/mouse **125** connected to the computer **100**. As described above, the USB disk drive interface **205**A corresponds to the FAT partition **1001**. For this reason, the folder **300** stores the CaptureApplication.exe **210**, the Control.dat **204**, and the CommonData.dat **220**. The FAT partition **1001** is formed by the FAT file system. For this reason, the folder **300** is recognized as the FAT file system by the computer **100**.

FIG. **6** is a view showing a state in which the disk drive corresponding to the USB disk drive interface **205**B is opened by file management software. The HFS+ partition allocated in the internal memory of the scanner device **106** corresponds to a folder **310**.

Like the folder **300**, the folder **310** can be opened using the keyboard/mouse **125** connected to the computer **100**. As described above, the USB disk drive interface **205**B corresponds to the HFS+ partition **1002**. For this reason, the folder **310** stores the CaptureApplicationMac.app **211** and the ControlMac.dat **214**. The HFS+ partition **1002** is formed by the HFS+ file system. For this reason, the folder **310** is recognized as the HFS+ file system by the computer **100**.

An operation performed when the operating system **101** is, for example, Windows® will be described. Windows® supports the FAT file system but not the HFS+ file system. Hence, in Windows®, the folder **300** is recognized in Windows®, and the folder **310** is not recognized. The CaptureApplication.exe **210** is programmed to run on Windows®. Hence, this program is executable on Windows®.

An operation performed when the operating system **101** is, for example, Mac OS® will be described. Mac OS® supports the FAT file system and the HFS+ file system. Hence, in Mac OS®, both of the folders **300** and **310** are recognizable. The CaptureApplicationMac.app **211** is programmed to run on Mac OS®. Hence, this program is executable on Mac OS®. However, the CaptureApplication.exe **210** is not programmed to run on Mac OS®, and this program is inexecutable on Mac OS®.

In step S**306**, the CPU **121** determines whether an instruction to activate the capture application in the folder **300** is input. This instruction is input by the user from the keyboard/mouse **125**. When the instruction to activate the capture application is input, the process advances to step S**307**.

In step S**307**, the CPU **121** reads out the capture application from the scanner device **106**, loads it to the memory (RAM **124**), and activates it. The USB interface **107**, the USB controller **128**, and the CPU **110** of the scanner device **106** transmit the capture application to the computer **100** in accordance with a read instruction from the computer **100**. The USB interface **107** and the like of the scanner device **106** are an example of a transmitting unit that transmits a control program stored in the storage unit to the information processing apparatus. The CPU **121** reads out the OCR data CommonData.dat **220** from the scanner device **106** and uses it in accordance with the activated capture application. For example, when the CaptureApplication.exe **210** is loaded to the memory and activated, it loads the CommonData.dat **220** in the same folder. On the other hand, when the CaptureApplicationMac.app **211** is loaded to the memory and activated, it loads the CommonData.dat **220** in the folder **300**. In fact, when the OCR function provided in the capture application has become active, the CPU **121** compares the read image data with the OCR data to execute character recognition. Hence, the OCR data need not always be loaded to the RAM **124**. However, loading the OCR data to the RAM **124** leads to improvement of the character recognition processing efficiency.

As described above, the CommonData.dat **220** is a file that is independent of the operating system and exists in the folder **300** created in the partition recognized as the FAT file system. Hence, the CommonData.dat **220** can be recognized from the above-described two operating systems, Windows® and Mac OS®.

When the shared data independent of the type of the operating system is arranged in the partition formatted by the file system commonly recognizable from a plurality of operating systems, the storage capacity of the scanner device **106** can be saved. That is, the storage medium such as the ROM **127** where the applications and configuration files are stored can have a small capacity.

In this embodiment, the scanner device **106** is controlled based on instruction information transmitted from the computer **100**. The instruction information from the computer **100** is written in the storage unit of the scanner device **106** upon software execution by the computer **100**. The CPU **110** of the scanner device **106** controls the operation of the scanner device **106** based on the instruction information written in the storage unit. For example, in this embodiment, the computer **100** is connected to the display **126** to display various kinds of user interfaces on it. That is, the computer **100** can actually display a user interface as shown in FIG. **7** or **8** by executing the capture application. The user can appropriately designate the control conditions of the scanner device **106** via the user interface.

FIG. **7** is a view showing an example of a user interface displayed upon activating the capture application **210**. FIG. **8** is a view showing an example of a user interface displayed upon activating the capture application Mac **211**. Each of the user interfaces shown in FIGS. **7** and **8** displays five items: "mode", "paper size", "resolution", "reading surface", and "OCR". As can be seen from the OCR set item, each of the CaptureApplication.exe **210** and the CaptureApplicationMac.app **211** includes a character recognition program that causes the information processing apparatus to execute character recognition processing. If the settings of the five items need to be changed, the user can change the setting of each item to a desired setting by operating the keyboard/mouse **125**. The file name (test1 in this embodiment) of the image file to store the read image is also input by operating the keyboard/mouse **125**. Finally, the user clicks a scan button **301** using the keyboard/mouse **125**.

When the scan button **301** is clicked via the keyboard/mouse **125**, the CPU **121** receives the scan setting (instruction information) and writes it in the control file in the scanner device **106**. In step S**308**, the CPU **121** also writes scan start command data (instruction information) in the control file. The control file is stored in a third partition (example: FAT partition) accessible and readable/writable from a plurality of different types of operating systems. Note that the above-described FAT partition **1001** is a readable/writable partition, the control file is written there. The third partition and the FAT partition **1001** are allocated in the RAM **203** such as a flash memory® or a readable/writable memory portion such as the EEPROM out of the ROM **127**. The HFS+ partition **1002** may also be allocated in a readable/writable memory portion such

as the EEPROM out of the ROM **127**. The RAM **203** or the ROM **127** thus functions as a storage unit that stores the control program to be executed by the information processing apparatus to control the peripheral device.

The CPU **110** of the scanner device **106** monitors the control file. Upon detecting that the scan setting and the scan start command data are written in the control file, the CPU **110** loads the control file, and controls the image reading unit **112** based on the scan setting written in the control file to start scan. When the scanner device **106** starts scan, the CPU **110** writes, in the control file, the image data read by the image reading unit **112**. The control file can be either the same as the control file that enables the scan setting or a different file. The CPU **110** thus functions as a control unit that controls the operation of the peripheral device based on instruction information that is written in the storage unit by the information processing apparatus in accordance with the control program executed by the information processing apparatus in a state in which it is connected to the peripheral device. The CPU **110** also functions as a control unit that reads out a reading control command written in the storage unit by the information processing apparatus in accordance with the control program executed by the information processing apparatus, and controls the image reading operation of the image reading apparatus based on the reading control command.

In step S**309**, the CPU **121** of the computer **100** monitors whether the image data is written in the control file. Upon detecting that the image data is written in the control file, the process advances to step S**310**.

In step S**310**, the CPU **121** reads out the image data from the control file. In step S**311**, the CPU **121** creates a designated image file (fine name "test**1**" in this embodiment) and stores it in the hard disk drive **122**.

To cause the computer **100** to process software such as the CaptureApplication.exe, it may be linked to a library module that allows dynamic linking. The CPU **121** may extract such a library module from the scanner device **106** and load it to the RAM **124**.

FIG. **10** shows processing of loading a library module from the scanner device **106** to the computer **100** in a case in which the operating system **101** of the computer **100** is Windows®. Steps S**901** to S**904** of FIG. **10** correspond to step S**307** of FIG. **4**.

As described above, the CPU **110** of the scanner device **106** allocates the FAT partition **1001** and the HFS+ partition **1002** in the RAM **203**, and reads out the CaptureApplication.exe **210** and the Control.dat **204** from the ROM **127** and writes them in the FAT partition **1001**. The CPU **110** also reads out the CaptureApplicationMac.app **211** and the ControlMac.dat **214** from the ROM **127** and writes them in the HFS+ partition **1002**. This enables to use the scanner device **106** regardless of whether the operating system **101** is Windows® or Mac OS®. The ROM **127** is a nonvolatile storage area where the control program is stored. The RAM **203** is a volatile storage area. The CPU **110** also functions as a control unit that reads out the control program from the nonvolatile storage area, stores it in the volatile storage area, and makes the volatile area open on the information processing apparatus as a drive accessible from the information processing apparatus.

In step S**901**, the CPU **121** of the computer **100** loads the CaptureApplication.exe **210** to the RAM **124** and activates it.

In step S**902**, the CPU **121** writes, in the Control.dat **204** that is the control file, a command to read out a file from the ROM **127** in accordance with the CaptureApplication.exe **210**. This command instructs to read out Library.dll **401** that is a library file stored in the ROM **127** and copy the file to the FAT partition **1001**. The CPU **110** of the scanner device **106** monitors the Control.dat **204** that is the control file. The Library.dll **401** can be the CommonData.dat **220**. That is, the Library.dll **401** is an example of data commonly usable by a plurality of different types of OSs.

In step S**903**, upon recognizing that the command is written in the Control.dat **204**, the CPU **110** reads out the Library.dll **401** from the ROM **127** and copies it to the FAT partition **1001**.

In step S**904**, the CPU **121** reads out the Library.dll **401** from the FAT partition **1001** and loads it to the RAM **124** in accordance with the CaptureApplication.exe **210**. This allows the CaptureApplication.exe **210** to use the Library.dll **401**.

Note that the library module such as the Library.dll **401** is a binary file and therefore sometimes has a relatively large size. To reduce the cost of the ROM **127**, the Library.dll **401** may be subjected to information compression in advance and then stored in the ROM **127** of the scanner device **106**. In this case, when reading out the Library.dll **401** in accordance with the CaptureApplication.exe **210**, the CPU **121** decompresses (expands) it and then writes it in the RAM **124**.

The library module loading method on Windows® has been described above. On Mac OS® as well, the library module can be loaded in accordance with the same procedure as described above.

More specifically, in step S**901**, the CPU **121** of the computer **100** loads the CaptureApplicationMac.app **211** stored in the HFS+ partition **1002** to the RAM **124** and activates it.

In step S**902**, the CPU **121** writes, in the ControlMac.dat **214** that is the control file, a command to read out a file from the ROM **127** in accordance with the CaptureApplicationMac.app **211**. This command instructs to read out Library.framework **402** that is a library file stored in the ROM **127** and copy the file to the HFS+ partition **1002**. The CPU **110** of the scanner device **106** monitors the ControlMac.dat **214** that is the control file.

In step S**903**, upon recognizing that the command is written in the ControlMac.dat **214**, the CPU **110** reads out the Library.framework **402** from the ROM **127** and copies it to the HFS+ partition **1002**.

In step S**904**, the CPU **121** reads out the Library.framework **402** from the HFS+ partition **1002** and loads it to the RAM **124** in accordance with the CaptureApplicationMac.app **211**. This allows the CaptureApplicationMac.app **211** to use the Library.framework **402**.

Note that the library module such as the Library.framework **402** is a binary file and therefore sometimes has a relatively large size. To reduce the cost of the ROM **127**, the Library.framework **402** may be subjected to information compression in advance and then stored in the ROM **127** of the scanner device **106**. In this case, when reading out the Library.framework **402** in accordance with the CaptureApplicationMac.app **211**, the CPU **121** decompresses (expands) it and then writes it in the RAM **124**.

The peripheral device of this embodiment may be a device such as a printer or multifunction peripheral having an image forming function. Control software such as CaptureApplication.exe may have a driver function of enabling to send a command concerning at least one of image reading and image forming and move image data from the scanner or to the printer or the like by transferring a file on the RAM recognized as a USB memory. The control software may also be linked to another program of a module having a driver function and enable to send a command concerning image reading or image forming and move image data from the scanner or to the printer or the like by transferring a file on the RAM recognized as a USB memory.

As described above, according to the present invention, control programs such as a device driver and software are stored in the peripheral device and transferred to the information processing apparatus. This enables to use the peripheral device without installing the control program in the information processing apparatus. Additionally, since the control program is prepared for each of a plurality of operating systems, the peripheral device can be used from the different operating systems. More specifically, the storage device provided in the scanner device **106** of the present invention stores a first control program (example: CaptureApplication.exe **210**) to be executed by an information processing apparatus including a first operating system and a second control program (example: CaptureApplicationMac.app **211**) to be executed by an information processing apparatus including a second operating system. Hence, each of the plurality of different types of operating systems can use the peripheral device by accessing the execution file executable by itself.

In the above-described embodiment, the FAT partition **1001** and the HFS+ partition **1002** are allocated. However, only the FAT partition **1001** may be allocated. This is because the FAT partition **1001** is a general-purpose area accessible by almost all operating systems. However, when different partitions are allocated in the RAM **203** for the respective operating systems, functions unique to each operating system can be used. For example, the HFS+ partition **1002** allows the contents of the partition to be automatically displayed using file management software when connected to Mac OS®. In addition, the control files can have the same name. This may be convenient from the viewpoint of management.

The CPU **110** functions as a control unit that analyzes instruction information written in the storage unit by the information processing apparatus, and upon recognizing that the instruction information instructs to write, in a volatile storage area, a predetermined file stored in a nonvolatile storage area, reads out the predetermined file from the nonvolatile storage area and writes it in the volatile storage area, thereby making the predetermined file open on the information processing apparatus. For example, an auxiliary file such as a library module may be read out from the scanner device **106** and used as needed by the software that controls the peripheral device. That is, at the timing the auxiliary file is needed, the computer **100** writes the command in the control file. The scanner device recognizes the command written in the control file and writes the auxiliary file from the ROM **127** to the RAM **203**. This allows the computer **100** to use the auxiliary file. Since the RAM **203** need only store the auxiliary file as needed, a larger free space can be ensured.

The predetermined file may be a file that has undergone information compression and is to be decompressed by the information processing apparatus before it reads out the file from the volatile storage area. Information compression of the auxiliary file enables to save the storage capacity of the ROM **127**.

In recent years, the program sizes of device drivers and software to use a peripheral device and the sizes of various kinds of data to be used by the programs increase along with the expansion of functionality of the peripheral device. The storage capacity of the storage device provided in the peripheral device is generally not so large from the viewpoint of the manufacturing cost. It is therefore difficult to store the device drivers, software, and various kinds of data, whose sizes are recently growing, in the peripheral device for each of a plurality of different types of operating systems. For example, data files independent of the operating system recently tend to increase the data amount. When the operating systems can commonly use the files, the storage capacity of the peripheral device can be saved.

The present invention provides a peripheral device usable from a plurality of operating systems without installing a device driver and software, an image reading apparatus, and an information processing apparatus with an inexpensive arrangement.

More specifically, according to the present invention, control programs such as a device driver and software are stored in the peripheral device and transferred to the information processing apparatus. This makes the peripheral device usable without installing the control program in the information processing apparatus. In addition, since control programs are prepared in correspondence with the plurality of operating systems, the peripheral device can be used from the different operating systems. Since data independent of the operating system is stored in the peripheral device as common data, the storage capacity of the storage unit can be saved. That is, a peripheral device usable from a plurality of operating systems can be provided with an inexpensive arrangement.

More specifically, the storage device provided in the scanner device **106** of the present invention stores a first control program (example: CaptureApplication.exe **210**) to be executed by an information processing apparatus including a first operating system and a second control program (example: CaptureApplicationMac.app **211**) to be executed by an information processing apparatus including a second operating system. The storage device also stores data (example: CommonData.dat **220** or Library.dll) to be commonly used by the information processing apparatus including the first operating system and the information processing apparatus including the second operating system. Since the data need not be stored for each of the plurality of different types of operating systems, the storage capacity can be saved, and an inexpensive peripheral device can easily be provided.

Especially, a first partition accessible from the plurality of different types of operating systems stores the first control program for the first operating system, and the data to be commonly used by the first operating system and the second operating system. A second partition stores the second control program for the second operating system. When the shared data is stored in the first partition, the data can easily be shared by the plurality of different types of operating systems.

In addition, when data having a relatively large size, for example, character data (OCR data) to be used for character recognition by the information processing apparatus that executes the character recognition processing program is used as the shared data, a large storage capacity saving effect can be obtained.

The above embodiment has been described assuming that the first operating system is Windows®, and the second operating system is Mac OS®. However, the present invention is not limited to the combination and arrangement and can cope with a combination of a plurality of different types of operating systems (including two or more types) as needed. The operating system may be based on UNIX®. It is possible to store control programs corresponding to, for example, Windows®, Mac OS®, and UNIX® and data to be commonly used in accordance with each combination of the OSs (two or more).

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No. 2011-064809 filed Mar. 23, 2011 and, 2011-079718 filed Mar. 31, 2011, which are hereby incorporated by reference herein in their entirety.

What is claimed is:

1. A peripheral device for executing image forming or image reading, comprising:

a communication unit that communicates with any of a first information processing apparatus including a first operating system (OS) and a second information processing apparatus including a second operating system (OS) whose execution file is incompatible with the of the first operating system;

a storage unit including:

a first storage area configured to store a first control program which is read and executed by the first information processing apparatus including the first operating system when the communication unit is connected to the first information processing apparatus,

a second storage area configured to store a second control program which is read and executed by the second information processing apparatus including the second operating system when the communication unit is connected to the second information processing apparatus; and

a third storage area configured to store data to be commonly used by the first information processing apparatus including the first operating system when the communication unit is connected to the first information processing apparatus and used by the second information processing apparatus including the second operating system when the communication unit is connected to the second information processing apparatus, wherein the third storage area is formatted by a file system recognizable by the first operating system and the second operating system;

a control unit that controls image forming or image reading of the peripheral device based on instruction information written in said storage unit from the first information processing apparatus executing the first control program and using the data when the first information processing apparatus is connected to the communication unit, and controls image forming or image reading of the peripheral device based on instruction information written in said storage unit from the second information processing apparatus executing the second control program and using the data when the second information processing apparatus is connected to the communication unit.

2. The device according to claim **1**, wherein

the first storage area is accessible by both the first operating system and the second operating system, and

the second storage area is accessible not by the first operating system but by the second operating system,

wherein the first storage area and the third storage area are the same storage area.

3. The device according to claim **2**, wherein

the first storage area is a storage area of a FAT file system, and

the second storage area is a storage area of an HFS file system.

4. The device according to claim **1**, wherein the control program causes the information processing apparatus to write the instruction information in the first storage area.

5. The device according to claim **1**, wherein

said storage unit includes

a nonvolatile storage area where the first control program, the second control program and the data are stored, and

a volatile storage area including the first storage area, the second storage area and the third storage area, and

said control unit reads out the first control program, the second control program and the data from the nonvolatile storage area, stores the first control program in the first storage area of the volatile storage area, stores the second control program in the second storage area of the volatile storage area, and stores the data in the third storage area of the volatile storage area, and makes the volatile area open on the first information processing apparatus when the first information processing apparatus is connected to the communication unit and the second information processing apparatus when the second information processing apparatus is connected to the communication unit as a drive accessible from the first information processing apparatus and the second information processing apparatus.

6. The device according to claim **5**, wherein said control unit analyzes the instruction information written in said storage unit by the first information processing apparatus or the second information processing apparatus, and upon recognizing that the instruction information instructs to write, in the volatile storage area, a predetermined file stored in the nonvolatile storage area, reads out the predetermined file from the nonvolatile storage area and writes the predetermined file in the volatile storage area, thereby making the predetermined file open on the first information processing apparatus or the second information processing apparatus.

7. The device according to claim **6**, wherein the predetermined file is a file that has undergone information compression and is to be decompressed by the first information processing apparatus when the first information processing apparatus reads out the file from the volatile storage area when the first information processing apparatus is connected to the communication unit and is to be decompressed by the second information processing apparatus when the second information processing apparatus reads out the file from the volatile storage area when the second information processing apparatus is connected to the communication unit.

8. The device according to claim **6**, wherein the predetermined file includes the data to be commonly used by the first information processing apparatus including the first operating system and the second information processing apparatus including the second operating system.

9. An image reading apparatus for executing image reading, comprising:

a communication unit that communicates with any of a first information processing apparatus including a first operating system (OS) and a second information processing apparatus including a second operating system (OS) whose execution file is incompatible with that of the first operating system:

a storage unit including:

a first storage area configured to store a first control program which is read and executed by the first information processing apparatus including the first operating system when the communication unit is connected to the first information processing apparatus;

a second storage area configured to store a second control program which is read and executed by the second information processing apparatus including the second operating system when the communication unit is connected to the second information processing apparatus; and

a third storage area configured to store data to be commonly used by the first information processing apparatus including the first operating system when the communication unit is connected to the first information

processing apparatus and used by the second information processing apparatus including the second operating system when the communication unit is connected to the second information processing apparatus, wherein the third storage area is formatted by a file system recognizable by the first operating system and the second operating system; and

a control unit that reads out a reading control command written in said storage unit from the first information processing apparatus and controls an image reading operation of the image reading apparatus based on the reading control command when the first information processing apparatus executes the first control program and the first information processing apparatus is connected to the communication unit and reads out a reading control command written in said storage unit from the second apparatus and controls an image reading operation of the image reading apparatus based on the reading control command when the second information processing apparatus executes the second control program and the second information processing apparatus is connected to the communication unit.

10. The apparatus according to claim **9**, wherein

said storage unit includes

a nonvolatile storage area where the first control program, the second control program and the data are stored, and

a volatile storage area including the first storage area, the second storage area and the third storage area, and

said control unit reads out the first control program, the second control program and the data from the nonvolatile storage area, stores the first control program in the first storage area of the volatile storage area, stores the second control program in the second storage area of the volatile storage area, and stores the data in the third storage area of the volatile storage area, and makes the volatile area open on the information processing apparatus as a drive accessible from the first information processing apparatus when the first information processing apparatus is connected to the communication unit and the second information processing apparatus when the second information processing apparatus is connected to the communication unit as a drive accessible from the first information processing apparatus and the second information processing apparatus.

11. The apparatus according to claim **10**, wherein said control unit analyzes the instruction information written in said storage unit by the first information processing apparatus of the second information processing apparatus, and upon recognizing that the instruction information instructs to write, in the volatile storage area, a predetermined file stored in the nonvolatile storage area, reads out the predetermined file from the nonvolatile storage area and writes the predetermined file in the volatile storage area, thereby making the predetermined file open on the first information processing apparatus or the second information processing apparatus.

12. The apparatus according to claim **11**, wherein the predetermined file is a file that has undergone information compression, is to be decompressed by the first information processing apparatus when the information processing apparatus reads out the file from the volatile storage area when the first information processing apparatus is connected to the communication unit and is to be decompressed by the second information processing apparatus when the second information processing apparatus reads out the file from the volatile storage area when the second information processing apparatus is connected to the communication unit.

13. The apparatus according to claim **11**, wherein the predetermined file includes the data to be commonly used by the first information processing apparatus including the first operating system and the second information processing apparatus including the second operating system.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,176,745 B2
APPLICATION NO. : 13/419334
DATED : November 3, 2015
INVENTOR(S) : Haruhiko Shirota, Hirokazu Higuchi and Hiroshi Ochiai

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

ON THE TITLE PAGE:

Please correct the Assignee name and residence as follows:

(73) Assignee:

"CANON KABUSHIKI KAISHA, Tokyo (JP)" should read --CANON DENSHI KABUSHIKI KAISHA, Saitama (JP)--

Signed and Sealed this
Sixteenth Day of August, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office